TORNADO CHARACTERISTICS IN OKLAHOMA

M. O. ASP

Weather Bureau Office, Oklahoma City, Okla.

[Manuscript received September 26, 1952; revised December 15, 1952]

INTRODUCTION

Persons in Oklahoma concerned with tornado warnings and local storm networks have many questions about tornado characteristics. Many of these characteristics, such as distribution by counties, length and width of paths, direction of travel, time of occurrence through the year, and time of occurrence through the day, have been published previously [1], [2].

Charts and tables that follow show analyses of other characteristics of tornadoes in Oklahoma. These analyses are based on data on all tornadoes in the State, for which record is available, from 1951 back through 1875 [3], [4].

WHEN DO TORNADOES OCCUR DURING THE DAY AT DIFFERENT TIMES OF THE YEAR? DO MORE TORNADOES OCCUR DURING THE DAYTIME THAN AFTER DARK?

Two questions commonly asked are when do tornadoes occur during the day at different times of the year, and do more tornadoes occur in the daytime than after dark.

Tornadoes can occur in any hour of the day and in every month of the year in Oklahoma, although maximum frequency is in late afternoon in April and May. Figure 1 shows the hourly distribution by months, as well as for the year, of tornadoes in Oklahoma for which there is reord of time of occurrence.

The curved lines in figure 1 show the approximate times of sunrise and sunset, and roughly separate the occurrence of tornadoes between daylight and darkness. This approximate daylight-darkness distribution shows that tornadoes in Oklahoma are about equally divided with 293 daylight occurrences as compared with 248 after dark.

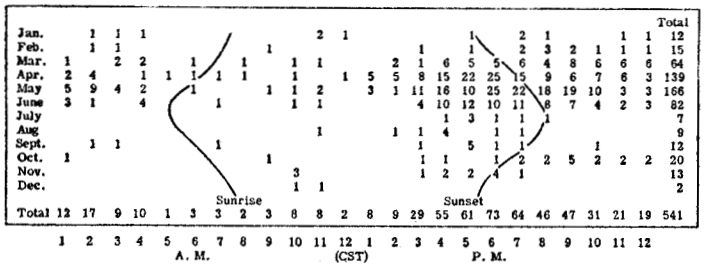

FIGURE 1.—Hourly occurrence of tornadoes in Oklahoma, 1875–1951. The data are tabulated for the hour *ending* at the indicated time (CST) and are counted for each hour in which tornadoes occurred, i. e., a tornado reported in 2 hours is counted for each hour. The superimposed curves indicate approximate time of sunrise and sunset in central Oklahoma.

Only 95 of the 541 tornadoes, or 18 percent occurred in the 14 hours between midnight and 2 p. m. After 2 p.m. the frequency rises sharply, and in the 5 hours from 2 p.m. to 7 p.m., more than half of all tornadoes occurred. Hourly distribution during the spring, summer, and fall, is much the same as for the entire year. During the winter months, a greater percentage occurred earlier in the day with about 40 percent before 2 p. m. as compared with between 17 percent and 20 percent for other months of the year.

IS THERE ANY DIFFERENCE IN THE HOURLY DISTRIBUTION OF TORNADOES AS RECORDED AT THE PRESENT TIME COMPARED WITH EARLIER YEARS IN OKLAHOMA?

There have been questions regarding the thoroughness with which tornadoes were reported in earlier years of Oklahoma's history, especially those occurring after dark. Figure 2 shows the distribution for different periods in Oklahoma history. If the 1885–1911 and 1912–1921 curves were combined the percentage distribution until about 2 p.m. would be much the same for the different periods. After 2 p.m., the curves show a somewhat greater frequency of tornadoes between 2 p.m. and 7 p.m. in earlier years, suggesting that a number after dark were not reported prior to 1921. After 1921 there seems to be close agreement.

IF ONE TORNADO IS REPORTED IN OKLAHOMA, WHAT IS THE CHANCE OF HAVING TWO OR MORE THAT SAME DAY OR NIGHT?

After a tornado has been reported in Oklahoma, there are many requests for information such as: Will there be another tornado tonight or, Will a tornado strike in this area tonight? These are valid questions by the public. Unfortunately, on many occasions when synoptic conditions are not changing rapidly, positive assurance cannot be given that another will not occur. It has been of some help, however, to advise how tornadoes in previous years have occurred. The remainder of this paper will deal with these questions.

When tornadoes occur in Oklahoma there usually is only a single tornado in any 24-hour period (from noon continuing through the afternoon, evening, and including the few that occur after midnight and before noon the next day). Figure 3 shows the number of occasions on which the indicated number of tornadoes occurred in one day. Two-thirds, or 66 percent were of single occurrence. On about 17 percent of the tornado days there were two tornadoes in the State, and on about 10 percent there were three tornadoes. On only 21 occasions in the entire history of Oklahoma tornadoes, have there been 4 or more tornadoes reported on a given day. The most outstanding of these occasions occurred in 1949, when on May 20–21 there were 21 tornadoes between 5:10 p. m. and 1:10 a. m., and on April 30 when 14 tornadoes were reported between 2:45 p.m. and 7:30 p.m.

WHEN A TORNADO OCCURS IN OKLAHOMA, HOW SOON WILL THE TORNADO ACTIVITY BE OVER?

Table 1 shows the time between beginning and ending of tornado activity in the State. In 76 percent of the times all tornado activity ceased in less than an hour after the first beginning of the tornado. A great many tornadoes were of only a few minutes duration. In only 6 percent of the times has there been tornado activity over a period of more than 6 hours. Some of these tornadoes occurring in a day 6 hours or more apart, were in separate storms.

Most tornado activity of less than an hour's duration consisted of a single tornado, while tornado activity of

TABLE 1.—*Time between beginning and ending of tornado activity*

	Less than 1 hour	1 hr.–1:59	2 hr.–2:59	3 hr.–3:59	4 hr.–4:59	5 hr.–5:59	6 hr. or more
Number of times.....	230	13	17	13	7	2	19

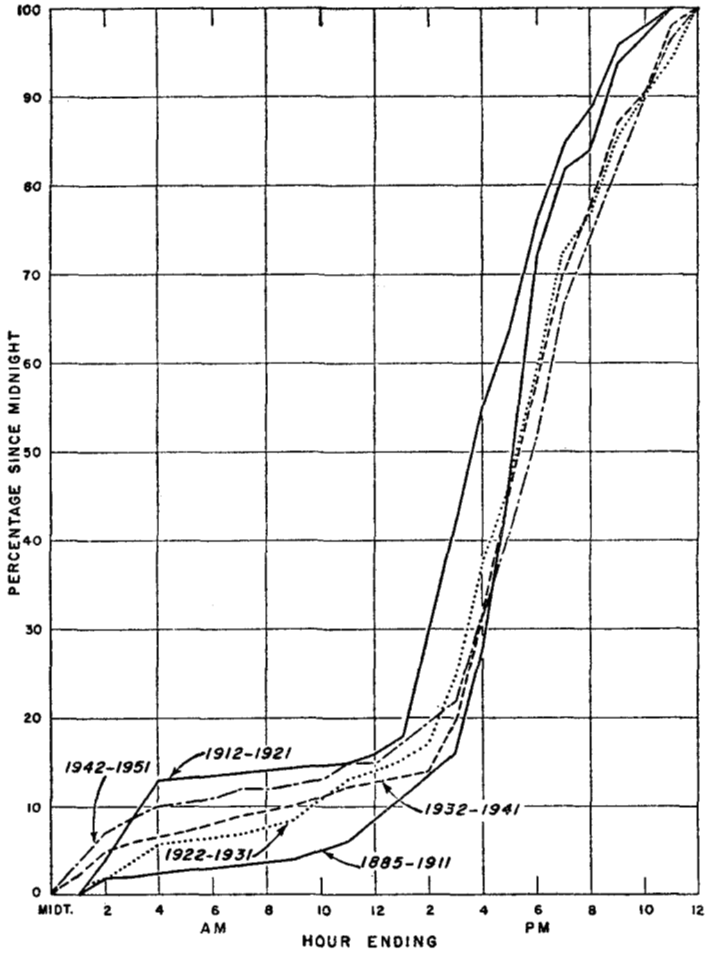

FIGURE 2.—Cumulative percentage of tornado occurrences in Oklahoma by hours since midnight (CST), for the periods 1885–1911, 1912–21, 1922–31, 1932–41, 1942–51.

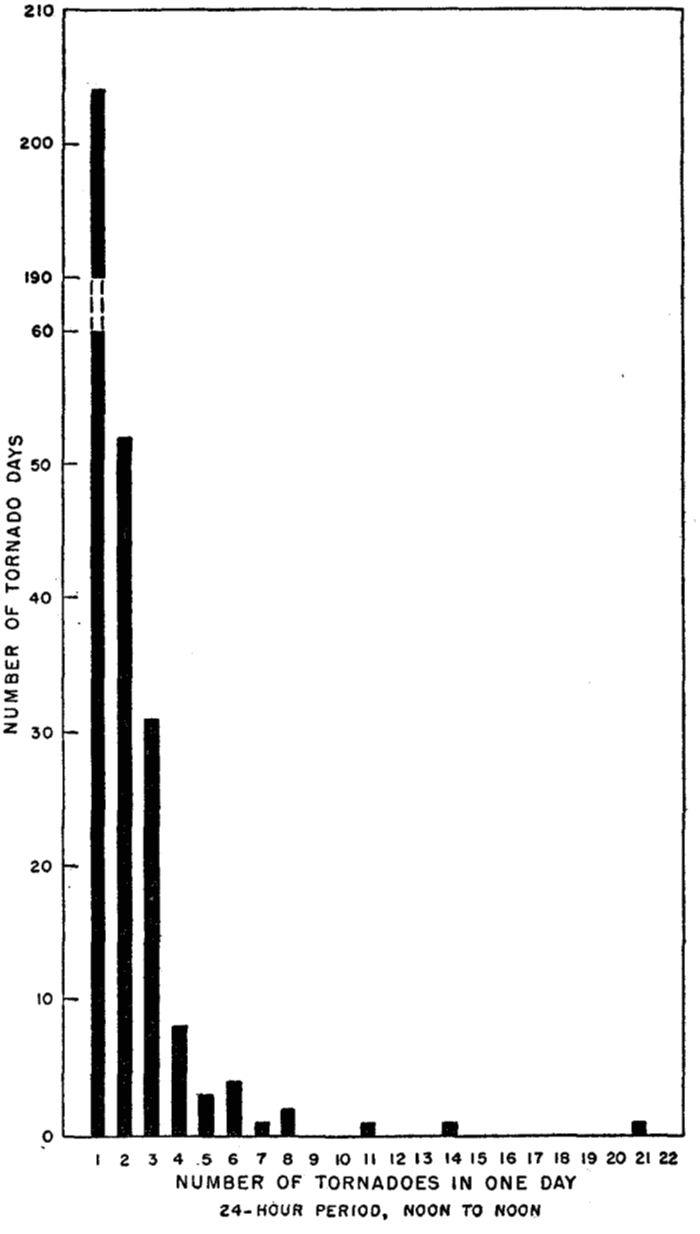

FIGURE 3.—Number of days with the indicated number of tornadoes per day in Oklahoma, 1875–1951.

longer periods, especially of 6 hours or more duration, was made up of a number of tornadoes with natural breaks between.

The duration time for a single tornado in Oklahoma seldom exceeds 3 hours. The longest lasting one was the devastating tornado that caused great destruction and loss of life at Higgins and Glazier, Tex., and Woodward, Okla. on April 9, 1947. In its 221-mile long path from White Deer, Tex. at 5:42 p.m. to near Hartner, Kans. around 11 p.m. there was continuous activity for more than 5 hours. The only other tornadoes in Oklahoma which continued for 3 hours or more were the Canton-Longdale-Blackwell tornado on March 30, 1949, the tornado that struck Wetumka on March 25, 1948, and the one that struck Pawhuska May 2, 1942.

IF A TORNADO STRIKES IN A GIVEN LOCATION, IN WHAT DIRECTION, AND AT WHAT DISTANCE MAY FURTHER ACTIVITY BE EXPECTED?

The 71 occurrences in table 1 where there was tornado activity of 1 hour or more duration, were checked for direction and distance between first and last activity. The results are shown in table 2.

About three-fourths of the tornado activity, when of 1 hour or more duration, continued in the quadrant from NE to SE of the first outbreak. In almost one-third of the cases the last tornado activity was NE of the first occurrence. There was some bias in favor of the directions NE, E, and SE over the adjacent points ENE and ESE, as there was a tendency for observers to report tornadoes moving in a NE, E, or SE direction, rather than in the intermediate directions. Relatively little tornado activity occurred in the westerly directions from the first outbreak.

Distance between first and last activity was usually 50 miles or less. Most of these cases were of less than one hour duration and therefore are not included in table 2. In only 14 cases did tornado activity continue for more than an hour within 50 miles of the first outbreak. The areas for the ≤ 50, 51–100, 101–150, and ≥ 151 groupings are not comparable as to size, and the areas involved should be considered in any comparison as to frequency of occurrence between the groups.

TABLE 2.—*Direction and distance between first and last activity (when one hour or more duration)*

Direction between first and last activity	Distance (miles between first and last activity) ≤50	51–100	101–150	≥151	Totals
N					0
NNE		2			2
NE	3	9	5	5	22
ENE		2	1	3	6
E	2	2	1	5	10
ESE	1		1		2
SE	4	3	5	2	14
SSE	1			1	2
S					0
SSW			1		1
SW	2	3			5
WSW			1		1
W	1		1		2
WNW		1			1
NW		1		1	2
NNW			1		1
Totals	14	23	17	17	71

ACKNOWLEDGMENTS

The writer acknowledges, with thanks, encouragement and suggestions for these analyses by Mr. W. E. Maughan, Meteorologist in Charge, U. S. Weather Bureau, Oklahoma City, Mr. H. E. Altman, SR & F Division, U. S. Weather Bureau, Washington, D. C., and the reviewers for the *Monthly Weather Review.*

REFERENCES

1. M. O. Asp, "Tornadoes in Oklahoma, 1875–1949," *Monthly Weather Review*, vol. 78, No. 2, Feb. 1950, pp. 23–26.
2. W. E. Maughan, *Facts about Tornadoes in Oklahoma*, Oklahoma City, April 1952, (Mimeographed).
3. M. O. Asp, Tornadoes in Oklahoma 1875–1949. (Contains tabulation of all tornadoes in Oklahoma 1875–1949 for which data are available.) (Manuscript. Copies on file Weather Bureau Office, Oklahoma City, Okla., and Weather Bureau Library, Washington, D. C.)
4. Tabulations of tornadoes in Oklahoma for 1950 and 1951, on file at Weather Bureau Office, Oklahoma City, Okla., and U. S. Weather Bureau, Washington, D. C.